

**WHAT IS CLAIMED IS:**

- 1           1.       A method of topographically mapping a surface, comprising:  
2           directing a radiation beam toward a target location on the surface;  
3           capturing an image of a beam spot at a location in an image plane  
4           intersecting at least a portion of the radiation beam reflected from the target  
5           location on the surface;  
6           identifying at least one image plane coordinate for a peripheral point of the  
7           beam spot image; and  
8           assigning a relative height value to the target location based on a mapping  
9           of the at least one image plane coordinate identified for the peripheral beam spot  
10          point to the relative height value.
- 1           2.       The method of claim 1, wherein the radiation beam is directed along  
2           a beam axis and an image plane coordinate is identified with respect to a first  
3           direction substantially parallel to a projection of the beam axis onto the image  
4           plane.
- 1           3.       The method of claim 2, wherein the peripheral point is located at a  
2           peripheral area of the beam spot closer to the beam axis than other comparable  
3           peripheral areas of the beam spot.
- 1           4.       The method of claim 1, wherein identifying the at least one image  
2           plane coordinate comprises applying a threshold to pixel values of the beam spot  
3           image.
- 1           5.       The method of claim 4, wherein a normalized grayscale threshold is  
2           applied to the pixel values of the beam spot image.
- 1           6.       The method of claim 1, wherein assigning a relative height value to  
2           the target location comprises mapping the at least one image plane coordinate to a  
3           predetermined relative height value.
- 1           7.       The method of claim 6, wherein the at least one image plane  
2           coordinate is mapped to the predetermined relative height value based on a  
3           lookup table.

1           8.       The method of claim 1, wherein the surface forms a boundary of a  
2       substrate and is semitransparent with respect to the radiation beam.

1           9.       The method of claim 8, wherein the substrate is a printed circuit  
2       board.

1           10.      The method of claim 9, further comprising repeating the steps of  
2       directing, capturing, identifying, and assigning for a plurality of target location on  
3       the surface of the printed circuit board arranged in a prescribed triangular mesh  
4       pattern.

1           11.      A system for topographically mapping a surface, comprising:  
2               a radiation source oriented to direct a radiation beam toward a target  
3       location on the surface;  
4               an imager oriented to capture an image of a beam spot at a location in an  
5       image plane intersecting at least a portion of the radiation beam reflected from the  
6       target location on the surface;  
7               a mapping engine operable to identify at least one image plane coordinate  
8       for a peripheral point of the beam spot image, and to assign a relative height  
9       value to the target location based on a mapping of the at least one image plane  
10      coordinate identified for the peripheral beam spot point to the relative height  
11      value.

1           12.      The system of claim 11, wherein the radiation source is oriented to  
2       direct the radiation beam along a beam axis, and the mapping engine is operable  
3       to identify an image plane coordinate with respect to a first direction substantially  
4       parallel to a projection of the beam axis onto the image plane.

1           13.      The system of claim 12, wherein the peripheral beam spot point is  
2       located at a peripheral area of the beam spot closer to the beam axis than other  
3       comparable peripheral areas of the beam spot.

1           14.      The system of claim 11, wherein the mapping engine is operable to  
2       identify the image plane coordinates by applying a threshold to pixel values of the  
3       beam spot image.

1           15.    The system of claim 14, wherein the mapping engine is operable to  
2    apply a normalized grayscale threshold to the pixel values of the beam spot  
3    image.

1           16.    The system of claim 11, wherein the mapping engine is operable to  
2    assign a relative height value to the target location by mapping the at least one  
3    image plane coordinate to a predetermined relative height value.

1           17.    The system of claim 16, wherein the mapping engine is operable to  
2    map the at least one image plane coordinate to the predetermined relative height  
3    value based on a lookup table.

1           18.    A computer program for topographically mapping a surface, the  
2    computer program residing on a computer-readable medium and comprising  
3    computer-readable instructions for causing a computer to:  
4            identify at least one image plane coordinate for a peripheral point of a  
5    beam spot image captured at an image plane intersecting at least a portion of  
6    radiation beam reflected from a target location on the surface, and  
7            assign a relative height value to the target location based on a mapping of  
8    the at least one image plane coordinate identified for the peripheral beam spot  
9    point to the relative height value.

1           19.    The computer program of claim 18, wherein an image plane  
2    coordinate is identified with respect to a first direction substantially parallel to a  
3    projection onto the image plane of a beam axis of a radiation beam directed  
4    toward the target location, and the peripheral beam spot point is located at a  
5    peripheral area of the beam spot closer to the beam axis than other comparable  
6    peripheral areas of the beam spot.

1           20.    The computer program of claim 18, wherein the at least one image  
2    plane coordinate is identified by applying a threshold to pixel values of the beam  
3    spot image.